ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

Nos. 172-174.] APRIL—JUNE. [1901.

I.—PLANT DISEASES.—II. LEAF-CURL.

(*Exoascus deformans*, Fuckel.)

(With Plate.)

This well-known disease is at times very destructive to peach foliage; less frequently almond and apricot leaves are also attacked. The popular name "leaf-curl," or simply "curl," has reference to the curled and distorted appearance of the diseased leaves. The infected tissue thickens and is at first of a pale green colour; then it gradually changes to purple or pink; and finally the convex parts of such leaves become covered with a very delicate whitish bloom, which presents a velvety appearance when seen through a pocket-lens. This effect is caused by the fruit of the fungus, which bursts through the cuticle of the leaf thus enabling the spores to be diffused by wind, rain, insects, &c.

The youngest shoots are also swollen and distorted by the parasite, whose mycelium is perennial in the branches and each season passes into the leaf-buds, which consequently contain the mycelium of the fungus in their tissues when they expand.

When once attacked a tree rarely recovers unless prompt preventive measures are taken, but becomes more diseased as time goes on, owing to the spread of the mycelium present in the tissues.

The parasite does not develop every season, at least not to any appreciable extent, even on trees that are known to contain mycelium in their tissues. It is least abundant during those years when the foliage reaches the fully developed condition without a check, whereas it is most abundant when the young leaves are checked in their growth by a sudden chill, and the more so if this chill follows damp warm weather. On the other hand, when evidence of the growth of the fungus has been unmistakable, its further course has been completely arrested by a sudden increase in temperature.

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The disease was exceptionally abundant in the South of England during the season following the very cold winter of 1894–95.

Frequently the disease is at first confined to one or few branches of a tree, but it spreads quickly, the spores being washed from diseased to healthy portions. During seasons when the disease is especially abundant, it is not unusual for the trees to lose all their leaves before midsummer. Later in the season a second crop of leaves appears, and these are not attacked by the fungus; nevertheless a considerable amount of injury is done, the crop of fruit in such cases is practically valueless, and the wood is imperfectly matured.

Nursery stock that has suffered from the disease is worthless.

Exoascus deformans is a very primitive type of the enormous assemblage of fungi known as Ascomycetes, which are characterised by having the spores produced within large cells or asci. These asci are produced in considerable numbers, and are usually imbedded in, or surrounded by a special protective structure, as in truffles, morels, &c. But in the present species, the scanty mycelium is located between the epidermis and cuticle of the host-plant, and gives origin to asci which burst through the cuticle unaccompanied by any kind of protective covering whatever.

Protective measures. — Leaf-curl is a disease which, if systematically and persistently attended to, can easily be kept in check. The mycelium of the fungus does not extend backwards in a branch from the point of infection, but follows the young growth, consequently all diseased branches should be cut out behind the point of infection. There should be no hesitation about pruning, for when a branch is once diseased it does not produce fruit, but only fungus spores, and these infect other healthy branches.

Diseased fallen leaves should be collected and burned.

Where the disease has been present in the preceding season the trees should be sprayed with dilute Bordeaux mixture just when the leaf-buds are expanding, to guard against infection from floating spores.

Fig. 1, Diseased peach leaves; nat. size. Fig. 2, Section of portion of a leaf, showing the asci seated upon the epidermis and bursting through the cuticle; × 400.

III. SYCAMORE LEAF-BLOTCH.

(*Rhytisma acerinum*, Fries.)

(With Plate.)

The conspicuous black spots so common on the upper surface of living leaves of *Acer Pseudo-platanus* (sycamore), *A. campestre* (maple), *A. rubrum*, and *A. platanoides* are of fungous origin, and when present on almost every leaf, as is usually the case in attacked trees, do considerable injury by causing premature defoliation. The wood in such a case is imperfectly matured, and

rendered highly susceptible to the attacks of other parasitic fungi, more especially of *Nectria cinnabarina*, which soon covers the branches with its beautiful coral-red, wart-like clusters of fruit. Young trees soon succumb to the combined attack of these fungi, and it is not at all unusual to see branches of large trees killed by the same means.

The fungus first causes yellowish blotches to appear on the leaves in June or July; these spots soon change to brown and then black, increase in thickness, and the upper surface becomes corrugated or wrinkled. During the autumn the surface of the blotches becomes covered with myriads of very minute bodies called spermatia; their function is not known, and they have not been observed to germinate.

During winter, after the leaves have fallen, fruit is produced in special portions of the black patches, and the needle-shaped spores escape in the following spring, when they are carried by wind. Those that happen to alight on damp young sycamore leaves germinate, enter the tissues, and give origin to the black patches.

Protective measures.—Remembering that the disease depends on the presence of spores formed on dead and fallen leaves in the spring, all that is necessary to prevent the appearance of the fungus is to collect and burn all fallen leaves before the spores escape. Where this has been done thoroughly the disease has ceased to exist.

Fig. 3, A sycamore leaf showing *Rhytisma* blotches; nat. size.

G. Massee.

II.—GUTTA PERCHA FROM A CHINESE TREE.

(*Eucommia ulmoides*, Oliv.)

Between 1887 and 1890, from several localities on the middle Yangtze-Kiang river, Dr. A. Henry sent to Kew fruiting specimens of a peculiar Chinese plant, with the statement that its bark is a most valued medicine in China, where it is named "Tu-chung," and that the tree is cultivated for it. "I have never seen it wild," he adds, "but I was informed it occurs so in Fang and other districts to the north." Fang is the name of a region near the middle part of the Yangtze-Kiang in the province of Hupeh.

This plant Prof. D. Oliver described (*Hooker's Icones Plantarum*, t. 1950) as *Eucommia ulmoides*.

Flowers not being available, and what material he had so peculiar that its relationships were not obvious, Prof. Oliver left the determination of the order of *Eucommia* open, merely adding that the tribe Phyllantheæ of Euphorbiaceæ occurred to him as of probable affinity.

The interest to us lies not so much in this as in his indication of the presence in the tissues of gutta percha. The discovery he made known in the following words:—

"The most singular feature about the plant is the extraordinary abundance of an elastic gum in all the younger tissues—excepting

perhaps the wood proper,—in the bark (in the usual sense of the word), the leaves and petioles, and pericarp; any of these, snapped across, and the parts drawn asunder, exhibit the silvery sheen of innumerable threads of this gum."

His account continues: "The morphological relations and general histology of the cells which give rise to the substance, we hope to have the opportunity of describing from specimens in fluid or living, which, through Dr. Henry's kind offices, there is probability we may soon receive."

When the promised specimens arrived Mr. (now Prof.) F. E. Weiss undertook the examination of them, and from the account of his investigations, published in the Transactions of the Linnean Society (Series 2, Botany, iii., p. 243), the following sentences are drawn :—

"The threads of *Eucommia* consist of caoutchouc, for they are insoluble in alcohol, acids and alkalis, though they become soft when treated with ammonia. They dissolve in chloroform and turpentine, and swell up in ether. When heated they melt, and they burn with the characteristic smell of burning rubber.

"From the bark the rubber can very readily be extracted. If the bark be broken in pieces and pounded in a mortar, the mass can be roughly separated into two parts, one consisting of the tangled elastic threads, with small bits of broken bark adhering to them, the other chiefly of bits of bark containing, no doubt, smaller pieces of the threads. From both parts chloroform will dissolve out caoutchouc, a larger amount naturally from the portion which consists chiefly of the threads. Thus, a sample of the threads and bark weighing 443 mg. gave as much as 25 mg. of caoutchouc, while the remaining bark, weighing 607 mg., yielded only 6 mg. Taking the two quantities together, the yield of caoutchouc was 3 per cent. of the weight of the dry bark, and the same figure was arrived at independently by Prof. F. W. Oliver with another sample.

"The threads are clear and homogeneous, and the only impurity in the chloroform extract seems to be a little resin, which can be washed out with alcohol.

"Whether the bark can be made use of commercially I must leave to those who are more experienced in technical matters.

"The distribution of the caoutchouc-containing cells I had been able to determine from the dry material which I first examined, and these observations were confirmed by the examination of the material preserved in alcohol. They occur in the inner portions of the cortex, very much in the position in which the latex cells of *Euphorbia* are found, but are even more frequent in the secondary phloem, where they run between the companion cells, and in both cases present the appearance of very long narrow cells, attaining such a length that one only occasionally finds their ends.

"In the leaf a group of caoutchouc-containing cells accompanies the ramifying fibro-vascular bundles, running just below the phloem, while in the petiole and all along the bundle of the midrib they form two groups at the sides of the bundle, and do not run below it.

"The pericarp of *Eucommia*, which resembles in appearance that of the elm, is especially rich in these caoutchouc-containing

cells. Below the epidermis we find a few layers of large chlorophyll-containing cortical cells, which become very much compressed in the dry fruit. Within these are the fibro-vascular bundles, the main trunks running longitudinally, and connected by branching and anastomosing lesser bundles. The longitudinal bundles have a strong group of caoutchouc-containing cells accompanying them on their inner side, and immediately beneath them we find a large mass of circularly running cells of the same nature, forming quite a dense coat of hyphæ-like thin-walled cells, showing their cell-walls very distinctly when the caoutchouc has been dissolved out by chloroform."

These investigations did not settle the position of the genus, and Mr. Weiss left the matter with the remark that perhaps the tribe Crotoneæ might include *Eucommia* in preference to Phyllantheæ of the same order—Euphorbiaceæ.

Since these first researches, made on imperfect material, further knowledge has been due to the success of scientific and horticultural establishments in Paris in obtaining first dried flowering specimens and now living plants. From the museum of the Jardin des Plantes came the material whereby Prof. Oliver was enabled to publish a second figure (*Hooker's Icones Plantarum*, t. 2361), and Dr. Solereder's researches (*Berichte der Deutschen botanischen Gesellschaft*, xvii, 1899, p. 387) were made upon flowers sent to him from Paris and fruits supplied from Kew; while the living plants in cultivation at the Jardin Colonial, in the garden of the Faculty of Medicine, and by the firm of Vilmorin, Andrieux, & Co., have supplied material for the anatomical investigations of M. Barthelat (*Journal de Botanique*, xiv., 1900, p. 55) and the economic inquiry of MM. Dybowski and Fron (*Comptes Rendus de l'Académie des Sciences, Paris*, cxxix., p. 558).

Examination of the dried flowering specimens which had been received in 1894 from a French missionary—Père Farges—and were taken from trees cultivated in Szechuen, caused Professors Oliver and Baillon to agree in placing *Eucommia* in the order Trochodendraceæ. Solereder refers it to Hamamelidaceæ. It is impossible to discuss here the cause of this difference of opinion; let it suffice to say that it indicates the difficulty experienced in assigning to its true position this peculiar genus. Wherever from external morphological characters we place it, the allied plants are not rubber- or gutta-yielding plants. Solereder observes this, and compares in justification of his view the Hippocrateaceæ, in which caoutchouc cells are found in certain species.

There are great differences between the caoutchouc cells of *Eucommia* and of the Euphorbiaceæ. In the latter the whole system is one complicated network arising from the branching of cells which are present in the embryo, which grow with the growing plant, ramifying and uniting, so that the outflow of one cut vessel is more than its contents, because other vessels feed it as it bleeds. In *Eucommia* the caoutchouc vessels do not branch and unite, nor are they present, according to Barthelat, in the embryo. Their contents, too, are more of the nature of gutta percha than indiarubber; and in structure they are much more similar to the

cells which yield the gutta percha in *Dichopsis* than to the laticiferous vessels of *Hevea*, *Manihot*, *Sapium*, and other Euphorbiaceous plants.

To Weiss' description of the anatomy Barthelat adds somewhat. He found that the cortical parenchyma of the young stem contained abundant caoutchouc cells, sometimes running singly, sometimes two or three together. In the roots he found the same cells in the phloem, and in the petioles both in and below the phloem ; while in the leaf-blades they were very plentiful, running with the nerves and branching from them to end in a swollen extremity under the palisade parenchyma of the upper surface.

Caoutchouc is thus seen to be present in every part of the plant except the wood and the outer layer of parenchyma of the young roots.

We may now leave the anatomy of the plant to quote from the paper by MM. Dybowski and Fron of the economic possibilities which *Eucommia* may possess. The following statements are translated from pp. 559–560 of their paper :—

"Our attention was called to the similar way in which the contents of the laticiferous vessels of *Palaquium* and *Eucommia* become evident when the leaves are carefully broken ; and so we were led to apply to the different organs of the latter plant the procedure recommended by M. Jungfleisch for extracting gutta-percha from the leaves of the former. We experimented first on some fresh leaves of a plant of *Eucommia* grown in the Jardin Colonial. The leaves are 3 to $3\frac{1}{2}$ inches long and $1\frac{1}{2}$ to 2 inches wide. They are oval, pointed at the end, finely dentate, have short stalks, and in length resemble those of our common elm. Operating upon 20 grammes of dried leaves, we obtained 0·45 gr. of products soluble in toluene, which corresponds to a return of 2·25 gr. per cent. This return is poor, remembering that the fresh leaves contain 70 per cent. of water. The bark is full of laticiferous vessels. But the plant which we possess being still very young, we have not been able to take any branches away for examination.

"A second series of observations was made upon the fruits. The fruit is a samara, the length of it being $1\frac{1}{8}$–$1\frac{3}{8}$ inches, and the width nearly $\frac{1}{2}$ inch. Two hundred fruits weigh about 13 to 14 grammes. The extraction of matter soluble in toluene has given us the following results :—

1st attempt, 15 grammes yielded 4·09 gr. soluble in toluene
2nd „ „ „ „ 4·12 gr. „ „

i.e., 8·20 gr. from 30 grammes of matter, or a yield of 27·34 per cent. We worked with fruits not dried. The fruit contains a small proportion of water, equal to 7·4 per cent.

"The product obtained is of a brown colour with metallic reflections on the surface. Plunged into hot water it becomes soft again, stretches out in thin flakes like goldbeater's skin, and under pressure will take the impress of metal. In cooling it loses its suppleness and becomes quite hard.

"We have submitted the samples to M. Léauté, an authority on the subject, and he has been so kind as to authorise us to say that he considers the gutta percha of good quality. We have but one plant under observation in the Jardin Colonial, but experiments are being made as to the methods of propagating. As at present *Eucommia ulmoides* is only known to exist in China, it is not easy to get a quantity of seed ; and, further, germination seems slow and irregular. One sowing produced a single seedling after the lapse of six weeks, a second after five months, and others later. Fortunately cuttings seem to give better results. They will strike root at any season, and give vigorous plants ; but spring, when the branches are still leafless, seems to be the most favourable time for taking them."

Eucommia ulmoides promises to be hardy at Kew. In November, 1897, M. Maurice L. de Vilmorin presented a plant to the Royal Botanic Gardens, where it has been grown successfully in the open without protection.

In Paris, where the winters are more severe than at Kew, the plant has survived through them, as testified by the following answer dated November 13, 1899, kindly sent by M. M. de Vilmorin to a question from Kew :—

"Two plants of *Eucommia ulmoides* remained unprotected against a wall in our Paris garden during the two last mild winters, and stood uninjured through as low a temperature as 18° or 19° F."

The Jardin Colonial has already experiments in hand in Annam, Tonkin, and North Africa.

The bark of *Tu chung* had attracted attention long before the discovery of the tree to which it belonged. The following notice appeared in the Kew Report for 1881, p. 47 :—

Chinese collections of Materia Medica often contain specimens of a drug consisting of blackened fragments of bark and small pieces of twigs. These when broken across are seen to contain an abundance of caoutchouc which can be drawn out in fine elastic threads as in the East African Landolphias. Specimens have reached the Kew Museum from the Paris Exhibition of 1878 (with the Chinese name *Tu chung*), and from the Smithsonian Institution, Washington. The botanical origin has been hitherto altogether uncertain. It seems, however, probable from a notice by M. L. Pierre, Director of the Botanic Gardens, Saigon (*Excursions et Reconnaissances*, No. 11, Saigon), that this drug is the produce of *Parameria glandulifera*. This is an apocynaceous climber, ascending to the summits of the highest trees ; it is common in the forests of Cochin China. Specimens which M. Pierre has obligingly communicated to Kew prove that the plant is identical with a species which abounds in Southern India. M. Pierre states that "the sap which flows from the stem has exactly the appearance of milk, and may even be used as a substitute for it ; it has a slight nutty flavour. In the liquid state it is often employed in medicine by the Annamites and the Cambodians. The bark, after being dried ordinarily in smoke, is sold at 20 to 25 francs the picul (= 133⅓ lbs.), and exported to China The bark is a medicinal product, esteemed by the Chinese."

The real source of the drug was cleared up when the specimen of *Eucommia*, collected in Hupeh in 1887 by Dr. A. Henry, was described in 1890 by Prof. Oliver in the *Icones Plantarum*. Dr. Henry's specimens were accompanied by the following note :—

The *Tu chung* tree, 20–30 feet. The bark of this tree is a most valued medicine with the Chinese, selling at 4*s*. to 8*s*. a lb.

Mons. Pierre concurred that the suggested identification with *Parameria* must be abandoned.

Subsequently further specimens were received from the Museum d'Histoire Naturelle, Paris. These had been collected in Szechuen in 1874 by Rev. Père Farges. They were accompanied by the following note :—

Lorsqu'on brise l'écorce les vaisseaux corticaux s'étirent comme des fils de soies ; c'est pour cela qu'il est appelé aussi vulgairement *sè mien*. Ecorce officinale usitée dans les maladies des reins et comme une charpie dans les blessures.

Eucommia is a tree of mountainous districts. The name *Tu chung* is, however, applied by the Chinese to a tree of the plains, which is almost certainly a *Euonymus*, and not improbably *E. hamiltonianus*, Wall. (See *Kew Bulletin*, 1899, p. 219).

III.—SOUTH AFRICAN LOCUST FUNGUS.

(With Plate.)

In many parts of the world the hopes of the agriculturist are frustrated by the sudden appearance of devastating clouds of locusts. Ingenuity has been taxed to find means of destroying them. Some account of the methods employed in the Caucasus was given in the *Kew Bulletin* for 1894 (pp. 215–217).

More recently a method has been devised in South Africa for effecting the destruction of locusts by spreading a disease amongst them. This disease is the result of their infection by a fungus. It admits of easy cultivation, and can readily be distributed to any distance in a portable form.

Some doubts having arisen as to the precise nature of the fungus, specimens were sent to Kew in January, 1900, by the Department of Agriculture, Cape of Good Hope, for examination and report. The whole subject has been carefully discussed in the following paper by Mr. Massee, F.L.S., Principal Assistant (Cryptogams) in the Herbarium of the Royal Botanic Gardens :—

The earliest observations relating to the presence of fungi on living insects refer to species included at the present day under the genus *Cordyceps*, Fries. The well-known "vegetable wasp," or *Guêpe Végétale*, of the West Indies was one of these. In the latest monograph treating of the genus *Cordyceps*[1] 62 species are described as growing on the bodies of different kinds of insects, ants, and scale insects. Among such are included *Cordyceps sinensis*, Sacc., the celebrated Chinese drug, called *Tong-chong-pa-cho*, signifying that it is a plant in summer and

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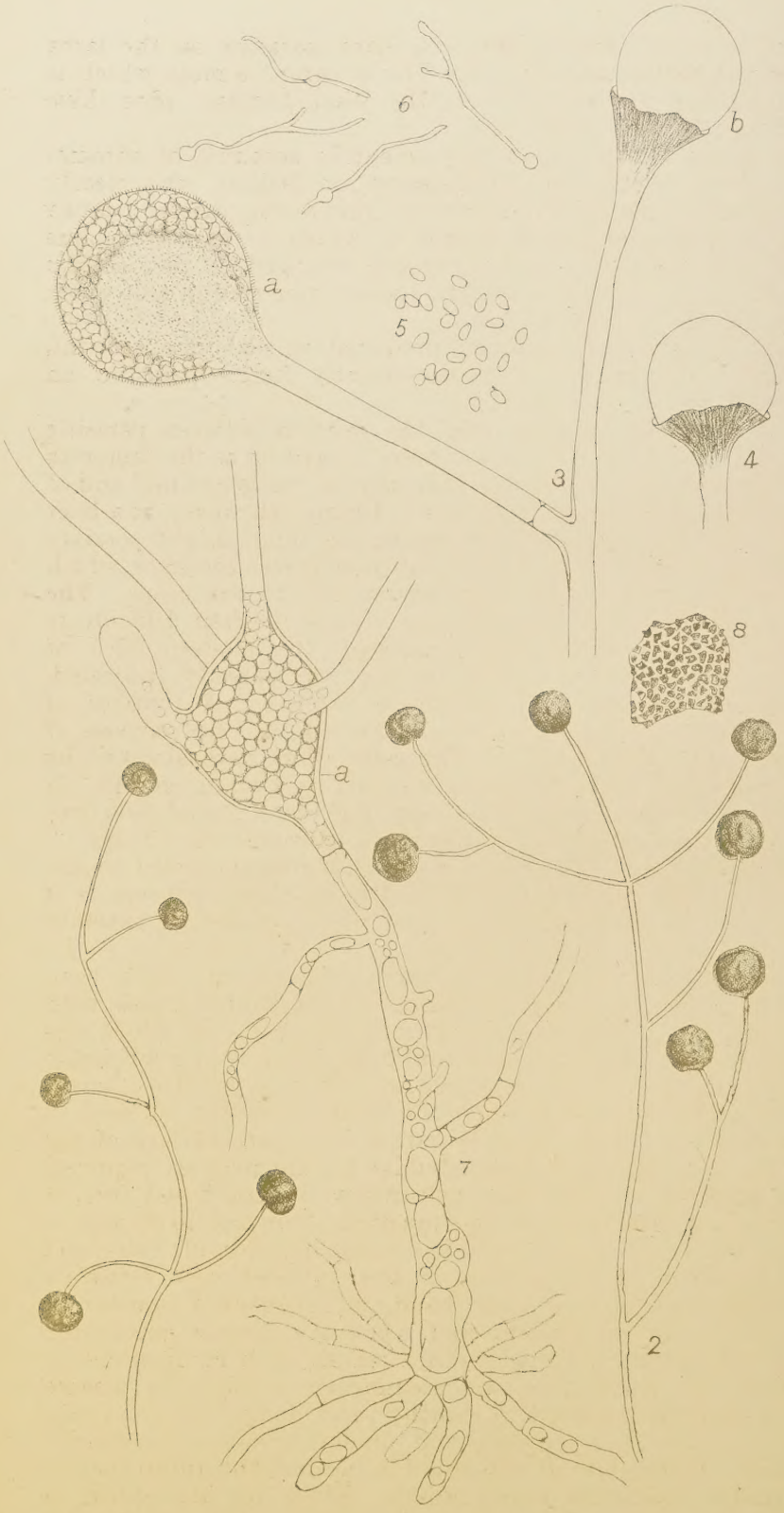

Mucor exitiosus, Massee.

1680.9.1901.

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a worm in winter, and *C. Barberi*, Giard, parasitic on the larva of *Diatræa saccharalis*, Fab., the "moth borer," a moth which is very injurious to sugar-cane in the West Indies. (See *Kew Bulletin*, 1892, pp. 153–178.)

Among the earliest of strictly scientific accounts of entomogenous fungi is the one by Balsamo, an Italian, who clearly demonstrated that the destructive silk-worm disease called muscardine is caused by a fungus to which he gave the name of *Botrytis paradoxa*[2], and afterwards changed it to *Botrytis bassiana*[3] in honour of M. Bassi, an Italian interested in silk-worm culture.

In 1853, Robin, a Frenchman, produced an elaborate account, beautifully illustrated, of plants—mostly fungi—parasitic on living animals[4].

Up to this year, in discussing the relation between parasitic fungi and their hosts, the former were looked on as the factor to be combated, and correctly so in the case of "muscardine" and of human diseases supposed to be due to fungi. However, at a later date the idea occurred that entomogenous fungi might possibly be utilised as a means of destroying those insect scourges which from time to time cause such devastation to our crops. The original inspiration of far-reaching results is often difficult to trace. Professor Sebert first suggested[5] the modern idea of utilising entomogenous fungi in the way already indicated. Sebert's observations were briefly as follows : A number of caterpillars of *Arctia villica* were collected for the purpose of observing their development. The caterpillars were attacked by a fungus, their bodies becoming covered by a white mould. It was observed that if diseased caterpillars were placed in a tree along with healthy ones, the latter soon contracted the disease.

Still more recently, Thaxter, in a beautifully illustrated monograph of the *Entomophthoreæ* of the United States, informs us of the widespread destruction among insects caused by various species of fungi[6].

During the last ten years extensive experiments have been conducted, more especially in France and the United States, with the object of perfecting some method by means of which the destruction of noxious insects could be effected in a wholesale manner, and by a process so simple and inexpensive that it could be practised by farmers and horticulturists. The line followed in all instances has been the preparation of a pure culture of the particular fungus found most effective for the purpose required. Tubes or flasks of such pure cultures were distributed free, or sold at a low price, and all the practical man had to do was to dissolve the contents of a tube in a small quantity of water and spray a portion of the ground or tree infested with larvæ or caterpillars ; or, on the other hand, to inoculate a number of captive larvæ or caterpillars, and when the disease manifested itself to liberate the infected victims among their companions in the field. In either case, the assumption is that the disease will spread from infected to healthy individuals. Theoretically the conception is excellent, and under certain atmospheric conditions the result is all that could be desired, but unfortunately the suitable conditions rarely prevail. When the atmosphere is dry the spores or conidia do not germinate, and inoculation by

contact takes place but slowly, whereas during an excess of moisture the conidia are washed into the ground and perish, while the larvæ or caterpillars do not move about, and contact-inoculation is arrested. During calm, damp weather the results are, as already stated, satisfactory.

In France the most destructive insect pest is the larva of the common cockchafer—*Melolontha vulgaris*, Linn.—known as *le ver blanc*, and the fungus utilised for its destruction is *Isaria densa*, Fries.

In the United States the "chinch bug"—*Blissus leucopterus*, Say—is very destructive to cereals. The fungus used for its destruction is *Sporotrichum globuliferum*, Speg., and, after the expenditure of a considerable amount of time and money, Professor Duggar, of the Cornell Agricultural Experiment Station, has expressed his opinion that, although effecting a certain amount of good at times, the outcome is not sufficiently efficient to be of any practical value.

A far greater measure of success appears to have attended the attempt to exterminate the devastating hordes of locusts, more especially the red-winged locust—*Acridium purpuriferum*, Walk.—in South Africa, by means of a fungous parasite.

The fungus was first observed, and its significance realised in 1896, by Mr. A. W. Cooper, of Richmond, Natal, who demonstrated that it could be readily cultivated, that it proved fatal in its effects on locusts, and that it was very contagious. (*Agricultural Journal, Cape of Good Hope*, viii., 1896, pp. 330–331.)

Mr. Cooper afterwards continued his investigations on the locust fungus in the Cape of Good Hope Colonial Bacteriological Institute, being aided by Dr. Black of that Institution, with the result that pure cultures were produced in large quantities, and tubes containing a small amount of the fungus were sold to farmers at sixpence each. In the report of the above-mentioned Institute for 1898, Dr. Edington, the Director, gives a fuller account of the fungus, accompanied by extracts from persons who had proved its efficacy on a large scale. The method of its application is so simple that the natives can use it with benefit. Dr. Edington thinks the fungus probably belongs to the *Entomophthoreæ*, but his very clear description and figures show conclusively that the fungus is a species of *Mucor*[7]. Up to the present, however, the fungus has been distributed as "the locust fungus," and no scientific name has been used.

Quite recently Mr. C. P. Lounsburg, Government Entomologist, Cape of Good Hope, addressed a letter to Kew, asking for a correct determination of the fungus, which, on account of its proved utility as a destroyer of locusts, it was presumed might also be of value in destroying fruit-tree caterpillars. In the meantime, Mr. D. McAlpine, Government Vegetable Pathologist of Victoria, had announced[8] that the Cape locust fungus was *Mucor racemosus*, Fres., hence a correct determination of the fungus became a necessity, as it is known that certain species of *Mucor* are destructive to fruit.

Six tubes containing the "locust fungus," two from Natal and four from Cape Colony, accompanied the letter from Mr. Lounsburg, and, on cultivation, proved to be pure cultures

of one and the same fungus—a species of *Mucor*. Spores obtained from this material were sown on sterilized bread paste, pineapple, and uninjured grapes respectively, and in each instance the matrix was completely covered with a dense snow-white mycelium within 24 hours. Six hours later the mycelium assumed a greyish tint, which microscopic examination showed to be due to the presence of myriads of globose sporangia of a pale grey colour, the mycelium remaining pure white. Forty hours from the sowing of the spores, the entire mass of mycelium was dark grey to the naked eye ; microscopic examination showed this appearance to be due to the innumerable mature black sporangia, the mycelium still remaining colourless, or at most here and there tinged with amber. The temperature ranged from 70° to 75° F.

The sporangia are globose and black at maturity, and the surface is frosted with a very delicate layer of lime crystals. The size varies considerably, depending on the substance on which the fungus is grown, but the average diameter is about 80 μ, although in many instances more than double that size is attained. The wall of the sporangium is pale steel-grey when seen by transmitted light. The large globose or broadly obovate columella is colourless. The spores are colourless, elliptical, and average 5–6 × 3·5–4 μ.

The sporangia are produced in a racemose or corymbose manner on short branchlets, which are often furnished with a transverse septum near the point of origin from the main branch, and are always immersed in the loose weft of superficial mycelium, contrary to what occurs in other species of *Mucor*, where the sporangia are elevated on elongated sporangiophores. The vegetative mycelium immersed in the matrix is very abundant, densely branched—the thickest portions varying from 10–25 μ in diameter—and expanding at intervals into irregular swellings containing reserve material. The thicker branches of immersed mycelium often contain large masses of a highly refractive substance in their interior. Septa are abundant in the mycelium immersed in the matrix, and are by no means rare in the aërial portions.

In addition to the nutritive media already enumerated, the fungus grew readily on gelatine containing a decoction of plum juice, in water containing a 10 per cent. solution of cane sugar, and in a sterilized decoction of decaying vegetable matter.

These experiments prove that the fungus is by no means circumscribed in its choice of a matrix, and consequently it would be unwise, without further knowledge of the possibilities of the fungus, to spray its spores on fruit trees, as those spores, carried to the ground in the solution, would probably be able to develope as a saprophyte on decaying vegetable matter, and the resulting spores would be very likely to attack the partly matured fruit.

It remains to state that the fungus attacks and kills cockroaches quite as quickly as it does locusts. An exotic species—*Periplaneta Australasiæ*, abundant in the warm houses in Kew Gardens—was experimented upon. Four half-grown specimens were sprinkled with water containing the spores of the fungus in suspension, and

fed with bread mixed with mycelium and spores. Twelve hours afterwards the cockroaches were only just able to crawl slowly; one of the number that was allowed to remain undisturbed died shortly afterwards, and within two days was covered with a dense white mycelium which eventually produced sporangia.

The remaining three enfeebled specimens were placed along with a dozen newly captured full-grown specimens, who, as was expected, promptly ate up their weakly companions. Within 24 hours the whole of the cannibals were dead and becoming covered with the *Mucor*.

In the letter referred to it is stated that there is a suspicion that the Natal locust fungus of to-day is not the same as the species discovered by Cooper.

The following may explain this suspicion. A fungus called *Entomophthora Grylli*, Fres., has long been known as a parasite on various species of crickets and locusts. Some years ago specimens of a fungus attacking locusts in South Africa were sent to the British Museum, and it was suggested by Miss A. L. Smith in *Science Gossip*, June, 1895, that the fungus was an *Entomophthora*. Some months ago Mr. J. H. Hart, Superintendent of the Botanic Garden, Trinidad, sent to Kew for determination a culture said to have been prepared from an example of the "locust fungus" received from the Cape Bacteriological Institution. This example was not a pure culture, but certainly included *Entomophthora Grylli*, Fres.

It is quite possible that *E. Grylli* does occur as a parasite on the South African locust, and that it may have found its way into certain of the cultures, but it is equally certain that it is not *E. Grylli*, but the *Mucor* described above, that is the potent factor in the "locust fungus" prepared at the Cape.

The following is a description of the *Mucor*, which proves to be an undescribed species :—

Mucor exitiosus, *Massee*. *Mycelium* lanosum, niveum ; hyphæ sporangiferæ decumbentes, racemose ramosæ, sæpius septatæ. *Sporangia* globosa, atra, 60–100 μ diam. ; columella globosa vel obovata. *Sporæ* hyalinæ, ellipsoideæ, 5-6 × 3·5–4 μ. *Zygosporæ* ignotæ.

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7. Report of the Director of the Colonial Bacteriological Institute for 1898 ; Cape of Good Hope, 1899, p. 84.
8. Brief report on Locust—Fungus imported from the Cape ; D. McAlpine ; N.S. Wales Agric. Gaz., x., Nov., 1899, p. 1213, and xi., March, 1900, p. 184.

Description of the Figures.

1–2. *Mucor exitiosus*, showing racemose and corymbose arrangement of the sporangia ; × 60.

3. Fertile branch bearing two sporangia ; *a*, entire, in optical section ; *b*, the sporangial wall and spores have disappeared, exposing the columella ; × 400.

4. A columella and base of sporangial wall ; × 400.

5. Spores ; × 400.

6. Spores germinating ; × 400.

7. Portion of vegetative mycelium immersed in the matrix, showing an irregularly swollen portion at *a* ; × 400.

8. Portion of a sporangial wall studded with minute crystals of lime ; × 800.

IV.—PLANT POISONOUS TO TREK OXEN IN TRANSVAAL.

The following correspondence gives all the available information as to a plant extremely fatal to oxen in the Northern Transvaal. Its deleterious properties appear to have been known locally for some time, but only recently to have attracted more general attention :—

WAR OFFICE to ROYAL BOTANIC GARDENS, KEW.

(116/Cape/1657.) War Office, London, S.W.,
8th November, 1900.

SIR,

I AM directed by the Secretary of State for War to forward for your consideration a report on the death of a number of trek oxen alleged to have been poisoned by eating certain plants while grazing in South Africa.

Specimens of (*a*) a poisonous plant, *Euphorbium* (reputed), and (*b*) a non-poisonous plant are enclosed, and the Secretary of State would be obliged if you would cause them to be examined and identified, and would be grateful for any information that may be forthcoming as to their alleged poisonous action.

I am, &c.,
(Signed) R. H. KNOX.

The Director,
Royal Botanic Gardens, Kew.

(Enclosure.)

To the PRINCIPAL VETERINARY OFFICER, SOUTH AFRICA.

"*Re* alleged poisoning of trek oxen, the result of eating certain plants when at the grazing grounds."

I have seen no cases myself, and am indebted to Veterinary Lieutenant Sawyer for the symptoms and post-mortem appearances. He states : "In the majority of cases progress is rapid ; often the first thing noticed is the animal halts, trembles for a few seconds, and drops dead. In cases less severe the animal is tympanitic, lies down, groans with pain, there is a green discharge from both nostrils, and symptoms of gastro-enteritis are present."

The conductors of ox transport state : There are no premonitory symptoms ; oxen drop dead suddenly in the yoke, or the herd may be grazing, all apparently well and feeding, when one or more will fall suddenly and die.

I am given to understand samples of the plants in question have been submitted for your inspection, further that you have had them examined and classified by an expert ; therefore any attempt on my part to presume to attempt a description of the plants is unnecessary, and would be out of place. I am told there are three varieties—two poisonous, the third, although of the same family, not dangerous. The leaves of the latter are white on the underside. They grow on the northern slopes of the Magaliesberg, the plants appearing prior to the grass, and are therefore more attractive to the cattle than would be the case later in the season. Wherever the wild Syringa flourishes these plants are abundant.

Stock owners state : Cattle reared locally will not touch the plants, but those brought from other districts readily partake of them.

From the foregoing statement it would appear there are no premonitory symptoms, consequently no treatment.

Avoid the northern slopes for grazing purposes ; when this is done the trouble ceases.

Conductor Cartwright states : If the oxen are allowed to drink freely prior to going to the grazing ground where these plants grow no bad results follow if the cattle partake of them. This may be so, but it seems unworthy of credence, inasmuch as cattle do not drink much—if at all—in the early morning. I know of no compulsory method to induce them to change their habits.

Post-mortem appearances :—

Lining membrane of rumen, reticulum, and omasum intensely inflamed and easily detached. Rumen contained a quantity of the leaves of the plants.

Lining membrane of abomasum also inflamed and of a dirty slate colour.

Intestines showed catarrhal inflammation.

All other organs healthy.

Taking into consideration the facts adduced : firstly, the animals, although suffering from acute gastritis associated with inflammation of the intestines, die without showing signs of pain; and, secondly, that there is no change in the secretions, or evidence of any deviation of health, death being sudden, I am of opinion the poison must be absorbed during the primary process of digestion ; its action is central, insensibility is produced, and death takes place by coma.

(Signed) F. W. SHARP,
Veterinary Captain, A.V.D.

Pretoria,
September 30, 1900.

D.G.A.V. Department.

Forwarded for your information. I also enclose specimens of the poisonous plants, together with specimens of leaves which are similar but innocuous.

(Signed) MATTHEWS,
Veterinary Colonel, P.V.O.S.A.

Pretoria,
October 1, 1900.

ROYAL BOTANIC GARDENS, KEW, to WAR OFFICE.

Royal Botanic Gardens, Kew,
November 12, 1900.

SIR,

I HAVE the honour to acknowledge the receipt of your letter of November 8 [116 (Cape) 1657] enclosing a report, herewith returned, on the death of a number of trek oxen alleged to have been poisoned by eating certain plants while grazing in South Africa, and asking for their identification and for information on the subject.

2. The specimen labelled *Euphorbium* is *Chailletia cymosa*. This is a native of the Transvaal. It belongs to a genus of which perhaps some score of species are known from Tropical Africa. Of one, *Chailletia toxicaria*, the seeds are used as a rat-poison in Sierra Leone.

3. The poisonous properties of *Chailletia cymosa* have only lately attracted attention. The only information in our possession is contained in the enclosed extract from the *Agricultural Journal* published by the Department of Agriculture for the Cape of Good Hope for November 9 last.

4. The non-poisonous plant, of which a specimen was sent, is *Parinarium capense*. A note in the Kew Herbarium states that it is a "low shrub growing on the flats resembling the poison shrub, but not it. Called the apple by the Boers."

I am, &c.,
(Signed) W. T. THISELTON-DYER.

Sir Ralph Knox, K.C.B.,
War Office, London, S.W.

(Enclosure.)

EXTRACT from *Cape Agricultural Journal*, Vol. XV., pp. 663–664.

Poisonous Herb (*Chailletia cymosa*, Hk.).

By Saturday's post I forwarded to your Department a small parcel of a poisonous herb which grows abundantly in this district and is very fatal to cattle and any kind of ruminant. It seems only to be dangerous at this time of the year, just after the young shoots come out of the ground and cattle are ravenous after any green herbage. I have just lost eleven head of cattle and my neighbour seven. It is the first season I have been on the place, and had not been warned of its whereabouts, so for safety sake had my cattle herded near the homestead, and unfortunately kept them on the only patch of poison on the farm. The first intimation of it I had was a cow making a few turns and dropping dead, and all the others died within 46 hours, or three days after eating the poison. Some, as I have said, drop dead without any sign of being sick; others have fits, as with strychnine; in most cases their legs become paralyzed and they won't walk, and the least excitement kills them. I may also mention that after death the inner coat of the stomach peels off as if it had been boiled, and the animal does not blow up until after-death, when it does to a great extent.

Zwartkop, Pretoria,
September 18.

L. N. BEAN.

The plant is *Chailletia cymosa*, Hk., figured in *Hooker's Icones Plantarum*, table 591, from Burke and Zeyher's Magaliesberg collections (Aapjes River). In 1890 I received the plant from Dr. Brock, a medical man residing in Pretoria, with an account of its deleterious effect upon stock.

Chailletia toxicaria, a species native to Sierra Leone, is used as a rat-poison. The root is the part employed.

The elimination of the poisonous principle, probably a glucoside, does not come within my purview.

P. MacOwan,
Government Botanist.

It would appear from the symptoms and post-mortem appearances presented by the stomach that the plant is a local irritant as well as a strong nerve stimulant, but without making any direct experiments it is impossible to do more than suggest a trial of such anodynes and sedatives as chloral hydrate in doses of half an ounce every six hours. Laudanum may also be tried, giving two ounces for the first dose, followed by one-ounce doses every two hours until the symptoms are relieved. Tincture of belladonna may also be tried in similar doses.

D. Hutcheon,
Colonial Veterinary Surgeon.

V.—RESEARCH IN JODRELL LABORATORY, 1876-1900.

The Royal Commission on Scientific Instruction and the advancement of Science, commonly spoken of as the Devonshire Commission, in its Fourth Report (1874), p. 10, expressed the opinion that "it is highly desirable that opportunities for the pursuit of investigations in Physiological Botany should be afforded at Kew to those persons who may be inclined to follow that branch of science." Effect was given to this recommendation by the liberality of the late T. J. Phillips Jodrell, Esq., M.A., who built and equipped the small laboratory, which has since borne his name, at his own expense (*Kew Report*, 1875, p. 2). It was completed and immediately brought into use in 1876 (*Kew Report*, pp. 28, 29).

It is necessary to explain that the Laboratory is not an educational institution. Its purpose is to afford facilities for research on material supplied by Kew. Those who conduct research in it are assumed, therefore, to be already conversant with its methods and to be capable of prosecuting their investigations with no more assistance than such friendly advice as the Kew Scientific Staff may be able to give them.

From 1876 to 1892 the Laboratory was under the general supervision of the Assistant Director (from 1885 Director). In 1892 (see *Kew Bulletin*, 1892, pp. 245, 246) Dr. H. Dukinfield Scott, F.R.S., accepted the post of Honorary Keeper.

During the period of its existence the Jodrell Laboratory has amply fulfilled the expectations of its founder. A continuous

stream of original work has emanated from it. Many of the researches have been of fundamental importance. Amongst those may be specified :—

Sir J. S. Burdon Sanderson, F.R.S., on the Electrical Phenomena accompanying movement in *Dionaea*.
Prof. Church, F.R.S., on Albinism.
Mr. Gardiner, F.R.S., on the Continuity of Protoplasm.
Dr. Schunck, F.R.S., on the Chemical Constitution of Chlorophyll.
Prof. Bower, F.R.S., on Apospory in Ferns.
Lord Avebury, F.R.S., on the Forms of Seedlings.
Mr. Massee, on the Sugar-cane Disease, and on "Finger and Toe."
Prof. Williamson, F.R.S., and Dr. Scott, F.R.S., on the Fossil Plants of the Coal Measures.
Mr. Horace Brown, F.R.S., and F. Escombe, on the Absorption of Carbon Dioxide by Plants.

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VI.—MISCELLANEOUS NOTES.

MR. JOHN PURCELL QUINTON, a member of the Gardening Staff of the Royal Botanic Gardens, has been appointed by the Secretary of State for the Colonies, on the recommendation of Kew, Curator of the Botanic Station, Sierra Leone.

MR. AAGE ENGELBRETH CASSE, a member of the Gardening Staff of the Royal Botanic Gardens, has been appointed, on the recommendation of Kew, Director of the Plantations and Experimental Gardens in Hayti.

MESSRS. JAMES G. DUNCAN and GEORGE DOUGLAS, members of the Gardening Staff of the Royal Botanic Gardens, have been appointed, on the recommendation of Kew, Assistants in St. George's Park, Port Elizabeth.

MAXIME CORNU.—The death of this distinguished botanist has robbed Kew of a friend and correspondent of long standing. The Jardin des Plantes at Paris is part of a much larger organisation, the *Muséum d'Histoire Naturelle*. The horticultural side of it is the national botanical garden of France, and its head occupies the office in the larger establishment of *Professeur du Culture*. Between Cornu and his predecessors the most intimate relations had long subsisted with Kew. His death, which took place at Paris on April 3, at the early age of 57, severed prematurely a personal tie which had contributed greatly to the scientific interests of both institutions.

The hand of death has been heavy on the French botanical world. In recent years it has fallen successively on Duchartre, Baillon, Naudin, de Vilmorin and Franchet: all men in the foremost rank, whom their fellow-workers in England counted as sympathetic friends; and now the untimely and unexpected death of Maxime Cornu has come upon many of us—and not least at Kew—as a personal grief. I saw him last autumn in Paris full of the business of congresses into which he was throwing himself with irrepressible vivacity and energy. He had often complained of ill health, but nothing in his appearance had ever suggested to me ground for serious anxiety. I had hoped to induce him to pay us a visit this year. I could not go to his funeral. Nothing remains but the sad satisfaction of writing these lines to his memory.

Cornu was born July 16, 1843, at Orléans. The ability which he displayed in his schooldays seemed at first likely to be absorbed by studies on the literary side. But under the influence of his father and of his distinguished brother, Alfred Cornu, he devoted himself to mathematics, and with considerable success. He published in the *Nouvelles Annales de Mathématiques* papers on geometrical subjects. In my judgment there could be no better

preparation for a scientific career. Mathematics, as they are taught in France, habituate the mind to the grasp of general ideas and accustom it to rise from isolated facts to large generalisations. The descriptive side of science, it cannot be doubted, has a cramping influence, and it is the fate of too many of those who devote themselves to it to be unable "to see the wood for the trees." Cornu's mathematical studies, at any rate, decided him for a scientific career, and at the "École normale supérieure" he eventually fixed on botany. He was for a time assistant to Duchartre, professor at the Sorbonne, a man remarkable in many ways, but possessing in a more than ordinary degree the power of presenting with French lucidity the results of current research, not forgetting those of English workers. While with Duchartre, Cornu produced in 1873, as his doctoral thesis, his well-known memoir on the *Saprolegniaceæ*, to which the Academie des Sciences awarded the Desmazières prize. From the Sorbonne he moved to the Muséum as aide naturaliste to Brongniart, whose daughter he afterwards married. Brongniart brought down to our own day the best traditions of that illustrious school of French botanists whose philosophic insight into the principles of plant morphology and taxonomy has probably never been rivalled, and certainly not surpassed.

Under Brongniart, Cornu devoted himself to mycology. He published in a comparatively brief period a profusion of papers, in which one is at a loss whether to admire most the untiring industry, the sagacity, or the wide range of his work. Everything pointed to his taking a foremost place in this branch of botany. But no one can be a mycologist without being drawn into the study of plant diseases, in which fungi play so large a part. Vegetable pathology early attracted Cornu, and he did much excellent work in it. We owe to him the principle, now so familiar as to seem almost obvious, of preventive treatment by the careful destruction by burning of the *débris* of plants which may harbour resting-spores.

In 1868 a mysterious disease made its appearance amongst the vines in the South of France. Planchon, the professor of botany at Montpellier (who owed his early training to Kew), discovered the cause in an insect—*Phylloxera vastatrix*—introduced from the New World. The injury which this ultimately inflicted on the principal cultural industry of France has been compared, and probably with justice, to that of the most devastating of wars. That France has risen triumphant above this, as above so many other disasters, is but one example of the indomitable courage of its people. Cornu, from his official position and special qualifications, was necessarily at once absorbed in the task—hopeless as it seemed at first—of combating the scourge. For at least ten years, from 1872 onwards, he was occupied in little else. It is needless to enumerate the prominent positions in various inquiries which he filled; the most important was that of "Secrétaire de la commission académique du Phylloxera." His memoir on the whole subject published by the Academy has always seemed to me, for completeness and finish, a model of what such a research ought to be.

Cornu became the acknowledged authority on the subject of the Phylloxera. It had not been foreseen at first that the scourge,

when once emancipated from its American home, might, and probably would, invade every wine-growing country. There were those who thought it impossible that it could cross the Equator. The expectation was falsified, and, in spite of all precautions, it made its appearance at the Cape. I advised the Cape Government to have recourse to Cornu, and his services were as generously given as, I know, they were warmly acknowledged.

In 1884 Cornu succeeded Decaisne as Professor of Culture at the Museum—a position, if not so extensive in scope as that of the Director of Kew, scarcely less onerous. I had made Cornu's acquaintance some years before, and the circumstance of our similar official positions speedily brought us into closer intimacy. The position of an administrator under Government does not suit every temperament. The enthusiast must expect his ardour to be quenched with a good deal of official cold water. To Cornu, who had something of the engaging qualities of the *Méridional* this was hard to bear. My sympathy with him in his troubles, which were often not small, was certainly sincere, but I am afraid often seemed to him phlegmatic. In any case, the worries of administration pressed hardly on him, and, notwithstanding the counsels of common friends, diverted him from the scientific work which we all expected of him, and which his really brilliant powers entitled us to expect.

At the moment that Cornu entered on his new duties, France had turned its attention anew to the field in which, in the past, it had done so much—colonial enterprise. Cornu's ambition—and it was a legitimate one—was to utilise the somewhat dormant resources of the Jardin des Plantes in the work, much on the lines of Kew. For my part it was more than a pleasure to give him all the assistance in my power. Agriculture is the great civilising agency. To reduce nomadic and predatory tribes to cultural pursuits is perhaps one of the most effective of missionary enterprises. Cornu threw himself into the work with little short of passion. What he accomplished, both for the French colonies and for the enrichment of the gardens of his own country, with resources more limited than we have at our disposal in England, is to me surprising. But, unhappily, at the moment when he had attained some measure of success his forces failed him, and he was not allowed to see his work fully crowned with accomplishment.

Cornu was the most loyal of Frenchmen. Had he been less so, he would not have sacrificed to the interests of France the career he might have devoted to science. I cannot but fear that while he lived the sacrifice he made was not fully appreciated. Many of us have wondered that a man who had done so much had never been admitted to the Institute. But that recognition could not have been long delayed, and this adds another regret to his untimely death.

W. T. T. D.

Botanical Magazine for February. — *Agave Peacockii*, from Central Mexico, is now figured for the first time. The Kew plant, which flowered in the Palm House in December, 1899, and produced a scape, measuring, with the inflorescence, 14½ feet, is the

type specimen from the collection of the late Mr. Peacock, of Hammersmith. *Neillia Torreyi* is a rosaceous shrub which is widely distributed in North America, ranging from British Columbia, along the Rocky Mountain region, to New Mexico. The form figured has been called *N. malvacea*, and chiefly differs from the type in having fruits of 2 or 3 carpels instead of 1 or 2. The Kew plant was received from Professor Sargent, Director of the Arnold Arboretum. *Veronica glauca*, a native of Greece, where it grows in sandy fields, is a pretty, free-flowering annual, of which seeds were received from Hon. Charles Ellis, of Frensham Hall, Haslemere. Its flowers, though smaller than in wild specimens preserved in the Herbarium, were three-fourths of an inch in diameter. *Echidnopsis Bentii* is one of the succulent Asclepiadaceae. It was found by the late Mr. Theodore Bent in Southern Arabia, and was sent by him to Kew shortly before his death. *Rosa Seraphini* is closely allied to *R. agrestis*. It is a dwarf species with rather small flowers of a bright rose-colour, and is a native of Italy, Corsica, Sardinia, and Sicily. Seeds from which the Kew plants were raised were obtained from the Innsbrück Botanic Gardens.

Botanical Magazine for March.—*Hymenocallis schizostephana* is a distinct species, with fragrant flowers, from Brazil, a bulb of which was presented to the Royal Gardens by A. Worsley, Esq., of Isleworth. The perianth tube is green, $2\frac{1}{2}$ inches long, and its narrow, white segments are rather longer. *Modecca senensis*, from Mozambique and Delagoa Bay, is a unisexual climbing plant belonging to the Passifloraceae. The specimen figured is from a male plant which was raised from seeds communicated by Mrs. Monteiro, in 1884. Its flowers are fragrant. *Coelogyne Veitchii* was collected in Western New Guinea by Mr. Burke for Messrs. James Veitch & Sons, of Chelsea, by whom a plant was presented to Kew. It is a distinct species with long pendulous racemes of white flowers. *Kalanchoe Bentii* is a fine new species from the Hadramaut district of Southern Arabia, where seeds were collected by the late Mr. J. Theodore Bent. Its flowers are an inch and a half long, white, with pink on the unexpanded corolla-lobes. The Kew plant has a stem three feet high. Its leaves are thick, dagger-shaped, spreading and recurved, in form differing from all other species. *Masdevallia deorsum*, a native of New Grenada, is remarkable in having a strictly pendulous habit. Its flowers are comparatively large, yellow, blotched with bright red. The figure was prepared from a specimen grown in the garden of Sir Trevor Lawrence, Bart.

Botanical Magazine for April.—*Cladrastis tinctoria* is one of the rarest trees of the Eastern United States, where it is known as the yellow or Gopher wood. The specimen drawn was obtained from a large tree growing in the Royal Gardens. *Amorphophallus leonensis* is a native of Western tropical Africa, whence tubers were sent to Kew by Mr. Walter Haydon, Curator of the Botanic Station, Sierra Leone. Four varieties are known in cultivation,

The plant produces a very stout peduncle from three to eight inches high, bearing an erect, pyriform spathe, the predominating colour of which is purple. Its spadix is much thickened towards the top and nearly fills the mouth of the spathe, which it slightly exceeds in length. *Kalanchoe farinacea*, from Socotra, was raised from seeds sent to Kew by the late Mr. J. Theodore Bent, in 1897. It has large, entire, obovate leaves, and flowers three-quarters of an inch long, yellow and bright scarlet. *Rosa fedtschenkoana*, from the Turkestan and Kokan regions of Central Asia, has handsome white flowers with an unpleasant odour. The calyx is coated with red glandular hairs. Kew obtained a plant of this species from Mr. T. Smith, of Newry. *Stapelia nobilis* is an exceedingly fine new species closely allied to *S. gigantea*. It was sent to Kew by Mr. T. G. Griffiths, of Port Elizabeth.

Botanical Magazine for May.—*Wyethia mollis*, from California, is a stout perennial herb with large heads of golden-yellow flowers. The genus closely approaches *Helianthus*, but differs in having fertile ray-florets and a pappus of a few, unequal, rigid, persistent bristles. The specimen drawn was grown in the garden of the Rev. Canon Ellacombe, of Bitton. *Pyrus alnifolia*, native of Japan and China, is a small tree with white flowers about half an inch in diameter, and ellipsoid or subglobose, bright-red fruits. A plant of this, which flowered in the Kew Arboretum in May, 1900, was purchased from Mr. L. Späth, of Berlin. *Lonicera pyrenaica* is an old inhabitant of British gardens, having, according to Philip Miller, been cultivated in England since 1793. It grows at Kew in the Rock Garden, where it forms a small shrub and flowers freely in May and June. *Mesembryanthemum calamiforme* was figured from a specimen sent to Kew by Mr. Chalwin, Superintendent of the Cape Town Botanic Gardens. It has thick cylindric leaves 2 to 3 inches long, and rather large terminal flowers with white and pink petals. The beautiful *Manettia bicolor*, from Brazil, is a well-known stove-climber, and has been in cultivation at Kew for many years.

Hooker's Icones Plantarum.—The concluding part of the seventh volume of the fourth series (plates 2676–2700) was issued in February. It opens with a continuation of plates illustrating rubber-yielding plants. The first is *Castilloa australis*, Hemsl., a native of Peru ; but the exact locality is unknown. It is not unlike the original *C. elastica*, Cerv., and *C. Tunu*, Hemsl., represented by plate 2651 ; but it is quite distinct. *Castilloa* is one of the genera now much engaging the attention of travellers and merchants interested in the caoutchouc trade. The new *Journal d'Agriculture Tropicale*, especially, has taken up the subject very warmly. Eight more plates illustrate the genus *Sapium*. Among the species figured is *S. suberosum*, Muell. Arg., a native of Barbados. The drawing was made from the type in the Berlin herbarium, obligingly lent for the purpose by Dr. A. Engler, the Director of that establishment, who also

presented a specimen of this interesting tree. Kew possessed no specimen of a *Sapium* from Barbados, and no specimen belonging to the species in question. *S. ciliatum*, Hemsl., a native of North Brazil, collected both by Spruce and Trail, and referred to as a rubber-tree, is remarkable in having conspicuously ciliated leaves. The flowers are unknown.

Besides these rubber-trees belonging to the *Euphorbiaceæ*, a number of the *Apocynaceæ* are figured, including the new genus *Funtumia*, Stapf, founded upon African species formerly referred to *Kickxia*, a Malayan genus. *Funtumia elastica* and *F. africana* are the species figured.

Habenaria repens, Nutt. is noteworthy as one of the few aquatic orchids. It is widely spread in America, from South Carolina and Florida to Guatemala, Nicaragua, and throughout the West Indies to Guiana and South Brazil. Few orchids have anything approaching such a range of distribution. *Itoa orientalis*, Hemsl., a new genus of *Bixaceæ* related to *Idesia* and *Carrierea* is dedicated to the recently deceased Dr. Keisuké Ito, one of the pioneers of modern botany in Japan, and to Dr. Tokutaro Ito, his grandson, who formerly studied at Kew, and enriched the library by the gift of rare Japanese books on botany. *Gymnopodium*, Rolfe (*Polygonaceæ*), is a new genus allied to *Podopterus*.

Vegetable Fibres.—The papers relating to this subject, which have from time to time appeared in the *Kew Bulletin*, were collected in 1898, in a volume forming *Additional Series, II.* The impression, for a purely technical publication of the kind, has been somewhat rapidly exhausted, and has for some time been out of print. A new impression has therefore been issued, and is now on sale by His Majesty's Stationery Office.

Plants presented to the Herbarium during 1900.—Dr. Korshinsky, 616 sheets of Russian plants; Dr. A. Zahlbruckner, Cryptogamæ Austro-Hungaricæ; Mr. G. Gautier, continuation of Hieraciotheca Gallica et Hispanica; Rev. G. E. Post, fascicles 8 and 9 of Plantæ Postianæ; Dr. V. F. Brotherus, 134 mosses from Turkestan and 35 from New Guinea, etc.; Mr. F. Stephani, specimens of 23 new species of *Metzgeria;* Dr. A. Henry, 1,330 specimens from Szemao, Yunnan, and 500 from Kwangsi, collected by Mr. H. B. Morse; Miss F. M. Reid, 117 specimens from Kiukiang; Mr. St. George Littledale, a collection from Kamtchatka and the Amur River; Prof. Kingo Miyabe, 119 *Erysiphaceæ* from Japan, received through Mr. E. S. Salmon; Major D. Prain, 327 *Myrtaceæ* and 62 *Somerileæ* from the Malay Peninsula, and 134 miscellaneous Indian plants; Mrs. A. Gnosspelius and Mrs. I. L. Pain, the Himalayan herbarium of the late Mr. J. E. Winterbottom, consisting of about 1,500 specimens; Mr. J. F. Duthie, a large series of specimens of *Impatiens* from Northern India; Mr. C. Curtis, collections from Penang, including 62 rubber-yielding plants; Mr. H. N. Ridley,

collections from Singapore, etc.; Prof. A. Haddon, Malay Peninsula; Dr. M. Raciborski, 100 Cryptogamæ Parasiticæ, from Java; Mr. T. F. Cheeseman, 25 specimens from Rarotonga; Mr. E. Cheel, 35 Lichens from the neighbourhood of Sydney, New South Wales. African plants were presented by Mr. A. Whyte, who sent 1,500 specimens from Uganda; Archdeacon Johnson, 327 from Nyasaland; Sir G. C. Denton, 62 from Lagos; Messrs. W. H. Johnson and J. H. Holland, several collections from the West Coast; Mr. K. J. Cameron, 46 from Namasi, British Central Africa; the Hon. Mrs. Evelyn Cecil, 255 from Rhodesia; Prof. H. Schinz, 55 from German South-West Africa; Major Wolley Dod, 57 specimens, chiefly ferns, from the Cape Peninsula. A small collection made in the Cape Verde Islands by Mr. F. Newton was received from Mr. Isaac Newton. North and Central American collections have been received from Dr. N. L. Britton, the secretary of the Smithsonian Institution, Dr. M. Micheli, and Mr. E. J. Campbell. A small collection of Trinidad plants were sent by Mr. F. A. Lodge, and seeds and specimens of various species of *Hevea* from British Guiana, by Mr. G. S. Jenman. Mr. E. S. Salmon has presented various collections of *Erysiphaceæ* used by him in his monograph of the group, and numerous mosses.

Presentations to the Library during 1900.—Prof. G. Arcangeli, several papers on Italian Fungi; Mr. F. M. Bailey, two parts of his *Queensland Flora;* Dr. A. Baldacci, various papers, including one on the structure of the leaf and stem of the new *Forsythia europaea;* the Netherlands Minister, continuation of the late Dr. Boerlage's *Handleiding tot de kennis der flora van nederlandsch Indië;* Dr. H. Christ, several papers on Ferns, and a copy of his work, *Die Farnkräuter der Schweiz;* Dr. L. Errera, papers by himself, and others by the late Dr. Clautriau; Prof. P. Fliche, three papers on fossil plants; Dr. Otto Appel, a set of pamphlets by the late Dr. Knuth; Sir J. D. Hooker, part 5 of the *Handbook of the Flora of Ceylon*, and numerous pamphlets, and periodicals in continuation; *Icones Floræ Japonicæ*, part 1, from the College of Science, Imperial University of Tokyo; *Phanerogamæ et Pteridophytæ Japonicæ*, etc., from the editor, Mr. T. Makino; *Cryptogamæ Japonicæ*, etc., from Dr. Matsumura and Dr. Miyoshi; Dr. Lindman, his works on the *Leguminosæ* and Palms of South America; Prof. F. Niedenzu, the continuation of his valuable series of papers on the *Malpighiaceæ;* Dr. O. Penzig, numerous papers, including his *Floræ Ligusticæ synopsis* and his *Flora popolaire Ligure;* Miss J. R. Perkins, a copy of her *Monographie der Gattung Mollinedia;* Sir Ernest Satow, *The Cultivation of Bamboos in Japan;* Prof. Lester F. Ward, *The Cretaceous Formation of the Black Hills*, etc.; *Journal of the Department of Agriculture of Western Australia*, from the Secretary; *Annual Reports of the Watson Botanical Exchange Club*, 1887–1900, from the Secretary; Dr. D. H. Scott, *Studies in Fossil Botany;* The Trustees of the British Museum, *Botany of Cook's First Voyage*, part 1, and *Catalogue of Welwitsch's African Plants*, part 4; Dr. G. W. Parker, a manuscript catalogue of plants from Guiana

and adjacent countries, compiled by himself. Among the numerous presentations by the Bentham Trustees are a complete set of the *Reports of the British Association for the Advancement of Science;* a valuable manuscript of the *Ortus Sanitatis*, another of Macer and Pseudo-Apulejus ; a copy of the rare first edition of the *Herbarius*, dated 1484 ; a large quarto edition of *Le Grant Herbier*, circa 1517 ; Hill's *Profitable Arte of Gardening*, 1574 : Leeuwenhœk's *Arcana Naturæ*, editions 1 and 3 ; and the continuation of about 20 serial publications.

The foregoing list does not include numerous reprints and extracts presented by their respective authors, nor the periodicals received in exchange for the *Kew Bulletin*.